Ecoregion Chlorophyll *a* threshold values for New Mexico

EPA's *Nutrient Criteria Technical Guidance Manual for Rivers and Streams* states "data that are most useful in determining river and stream trophic status are water column nutrient concentrations and algal biomass" and that chlorophyll *a* concentration is used as a surrogate for algal biomass and is generally the most appropriate variable to monitor (USEPA 2000). In streams, benthic algae production and biomass are the most useful parameters in monitoring changes in water quality (USEPA 1991). Benthic chlorophyll *a* concentration is used as one of the indicators in the *SWQB Nutrient Assessment Protocol for Streams* (SWQB/NMED 2007).

In *Rapid Bioassessment Protocols (RBP) for Use in Streams and Wadeable Rivers* (Barbour, et. al. 1999), nuisance levels of algal biomass are defined as: greater than 10 micrograms chlorophyll *a* per square centimeter (>10 µg/cm^2). EPA's *Nutrient Criteria Technical Guidance Manual for Rivers and Streams* lists a number of algal biomass thresholds ranging from 10 to 20 µg/cm^2 (USEPA 2000). In earlier versions of the *SWQB Nutrient Assessment Protocol for Streams*, a threshold value of 10 µg/cm^2 was used (SWQB/NMED 2006). Refinement of the assessment protocol included development threshold values for each ecoregion (Omernik 2006) in New Mexico based on regional data. The process used to define these values is described below.

SWQB measured the chlorophyll *a* concentration at stream reference sites throughout the state of New Mexico and calculated the 95th percentile for each ecoregion. Because of the limited area and number of sites in the Madrean Archipelago (79), Western High Plains (25), and Colorado Plateau (20) ecoregions, these data where grouped with the most similar ecoregions; the Madrean Archipelago with the Chihahuan Desert and the Colorado Plateau with the Arizona New Mexico Plateau. The Western High Plains ecoregion is grouped with the Southwestern Tablelands but contained no stream data as the only surface waters are playas, therefore this ecoregion was not included in the analysis. For each of the grouped ecoregions, ten best available sites were selected based on the best professional judgment of the SWQB staff and discussions with land management agencies. Benthic chlorophyll *a* and a suite of chemical and habitat parameters were monitored at these sites in 2004 and subset in 2005 and 2006. These parameters were also monitored at test sites as part of regular water quality surveys.

Once the benthic chlorophyll *a* dataset was compiled, it was divided by ecoregion. The plan was to have 10 sites per ecoregion, however some of the test sites were determined to be of reference quality and added to the dataset. Two of the ecoregions had less than 10 as some of the best available sites were determined to not be suitable ecoregion reference sites at the time of sampling and even finding flowing streams during the drought was difficult in the AZ/NM Plateau and Chihuahuan Desert. The data from each ecoregion was tested for outliers. Those that were determined to be significant outliers at $P<0.05$ were removed from the dataset and the 95th percentile was calculated. These ecoregion specific threshold values are shown in the table below.

Table 4. Chlorophyll *a* ecoregion threshold values 95th percentile in µg/cm^2 (2004 and 2005 data)

21-Southern Rockies	22/20-AZ/NM Plateau	23-AZ/NM Mountains	24/79-Chihuahuan Desert	26/25-SW Tablelands
n = 21	n = 7	n = 15	n = 11	n =9
4	7	8	17	12

Table 4a. Chlorophyll *a* ecoregion threshold values 95th percentile in µg/cm^2 (with 2006 data)

21-Southern Rockies	22/20-AZ/NM Plateau	23-AZ/NM Mountains	24/79-Chihuahuan Desert	26/25-SW Tablelands
n = 32	n = 12	n = 18	n = 14	n =12
5	8	7	17	11

REFERENCES

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**Prior to 2004 chlorophyll *a* was routinely monitored in lakes but not in streams or rivers. As part of the nutrient criteria development project beginning in 2004, periphyton was collected from streams.